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Particle creation near the chronology horizon

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Abstract

We investigate the phenomenon of particle creation of a massless scalar field in a model of spacetime in which, depending on the model's parameter a 0, the chronology horizon could be formed. The model represents a two-dimensional curved spacetime with the topology R 1×S 1 which is asymptotically flat in the past and in the future. The spacetime is globally hyperbolic and has no causal pathologies if a 0<1, and closed timelike curves appear in the spacetime if a 0≥1. We obtain the spectrum of created particles in the case a 0<1. In the limit a 0→1 this spectrum gives the number of particles created in mode n near the chronology horizon. The main result we have obtained is that the number of scalar particles created in each mode as well as the total number of particles remains finite at the moment of the formation of the chronology horizon.